

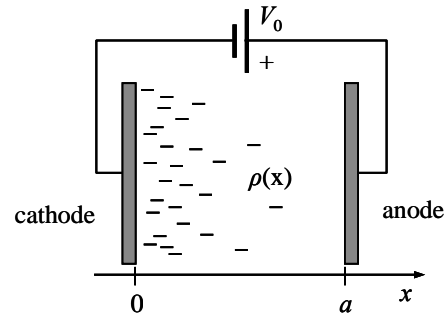
Reading Assignment:

Cheng: Sections 3.7–3.11
 Schey: review material as needed
 Cartoon Guide: Chapters 14-15

Homework #2**Due: Friday 9 October 2009**

- 1) Do problem P.2-32 in Cheng.
- 2) An infinite tube of radius a carries a surface charge density ρ_s [C/m²], and is coaxial with the z axis. Using Gauss' law and a convenient coordinate system, find the electric field both inside and outside the tube. Also find the electrostatic potential assuming a zero-reference at $r = a$.
- 3) Do problem P.3-7 in Cheng. It is probably easier to first find the potential and compute the field from that. Exploit the symmetry of the problem to simplify things.
- 4) Do problem P.3-21 in Cheng.
- 5) Do problem P.3-28 in Cheng.
- 6) Do problem P.3-35 in Cheng. Assume that the reference potential is zero at infinity.

- 7) A vacuum-tube diode is shown at right. The cathode is hot and emits electrons into the region between two parallel plates, where they travel towards the anode. In operation at a fixed anode voltage V_0 , the system reaches a steady-state described by a charge distribution $\rho(x)$. The plates are separated by a distance a , and the electrostatic potential between the plates is found to be



$$\Phi(x) = V_0 \left(\frac{x}{a} \right)^{4/3} \quad (1.1)$$

- a. Find the electric field vector \vec{E} between the plates.
 - b. Find the charge density $\rho(x)$ between the plates.
- 8) EXTRA CREDIT: On the course web site there is a FlexPDE script to plot the equipotential contours and electric field for two positive point charges. Modify the script to plot the potential and field for a short dipole, and turn in your script and resulting work (your script must have some unique identifier to receive credit.)